# Review of the ENERGY STAR® Solid State Lighting Luminaire Criteria

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July 10, 2008

# Guiding Principles for ENERGY STAR Criteria Development

- Significant energy savings
- No impact on product performance
- ENERGY STAR qualified product is cost effective
- Several technology options can achieve criteria setting (one of which is non-proprietary)
- Energy consumption can be quantified
- Label differentiates products and is visible to purchasers

# Competing Criteria

- DOE agrees with stakeholder concerns and is working to resolve the issue as quickly as possible
- DOE recognizes there can only be one ENERGY STAR criteria for SSL
- Significant conflict/overlap exists. They are not complementary

# Comparison of DOE – EPA Criteria


## DOE

- Luminaire Efficacy
- Limited CCTs
- First limited applications – eventually all encompassing
- References industry accepted test procedures
- Minimum Light Levels

## EPA

- Source Efficacy
- 8 different CCTs
- Applies to all applications except recessed cans
- References test procedure developed by a single lighting lab
- Silent on Light Levels

# DOE Commitment

- Maintain open process with stakeholder involvement
- Continue to focus on product quality
  - Using standards and test procedures recognized by industry standards organizations (e.g., IESNA, ANSI, CIE, etc.)
- Moving forward with the SSL criteria and program launch.

# Agenda

- Background behind the ENERGY STAR SSL criteria
- Current status of the criteria
- Future direction of the criteria

# Why ENERGY STAR?

- DOE has been involved in the commercialization of SSL for a number of years.
- Products were beginning to show up on the market.
- The quality of some of those products left a lot to be desired.
- We do not want a repeat of our experience with CFLs.

# We needed a program to:

- Help referee the playing field
- Establish minimum performance requirements for SSL luminaries
- Put SSL in a position to succeed with consumers
- Initially focus on well-defined applications that meet and exceed expectations

# Rationale

- Ensure quality products are available
- Generate satisfied, loyal customers
- Start slow, then speed up
  - Two category approach
- Provide flexibility up front to minimize testing costs knowing there will be consequences on the back end
- Achievable efficacy requirements

# Accommodate Rapid Technological Advances

- Approach recognizes rapidly changing technology
  - Technological improvement exceeds projections
- Allows early participation of limited range of SSL products (Category A)
- In about 3 years, Category A will be dropped entirely; Category B then becomes basis of criteria

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# A Transitional Approach

- Initially limits types of products – Category A
  - Take advantage of SSL's core characteristics
  - Application-specific measures ensure quality lighting
    - Zonal lumen density
    - Minimum light output
    - Minimum luminaire efficacy
- Rigorous targets for future applications – Category B
- Adapts to rapid technological advances

# Near Term Applications

- Establish minimum luminaire efficacy
  - Benchmarked to fluorescent
    - Consistent with current ENERGY STAR lighting criteria
- Directed light applications
  - Energy efficiency potential due to directional light source
  - Minimize luminaire losses
- Some application-specific requirements

# Category A Applications

1. Under-cabinet Kitchen Lighting

# Category A Applications

2. Under-cabinet Shelf-mounted Task

# Category A Applications

3. Portable Desk/Task

# Category A Applications

4. Recessed Downlights (Res./Com.)

# Category A Applications

5. Outdoor Wall-mounted Porch

# Category A Applications

6. Outdoor Step

# Category A Applications

7. Outdoor Pathway

# Category B Applications

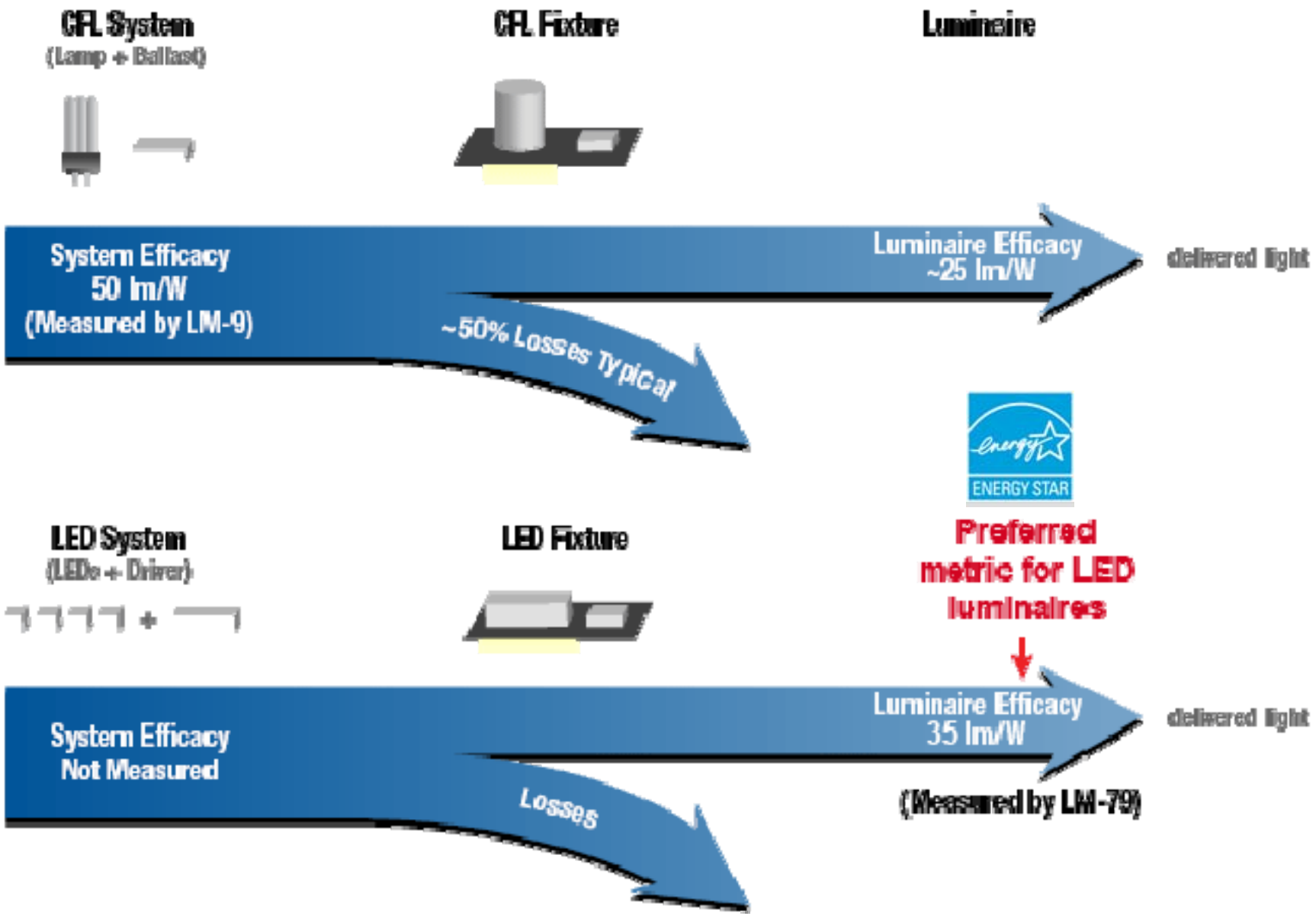
- Manufacturers can qualify for Category B in 2011
- 70 lm/W efficacy requirement
- Applies to all types of SSL systems for general illumination
- Category A will be dropped

# The Right Metric

- Establish minimum **luminaire efficacy** for each application
  - System or source efficacy cannot be measured in SSL Luminaires
    - 40 yard dash in helmet, pads, and full gear
    - 40 yard dash in shorts & t-shirt

# System Efficacy Vs. Luminaire Efficacy

## (Recessed Downlights Example)



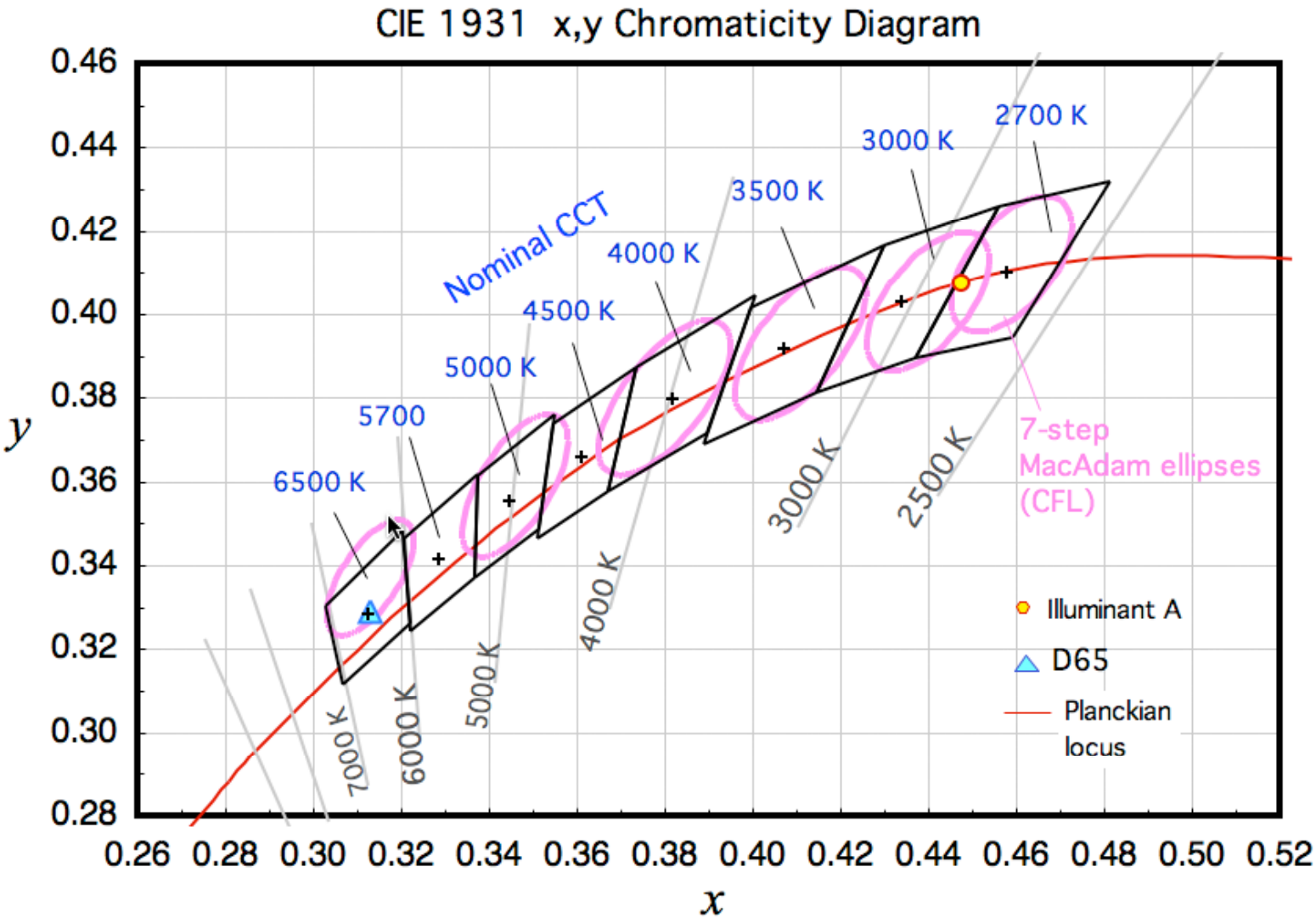
# Overall Requirements

- Luminaire
  - CCTs:  8 nominal CCTs
  - Color Spatial Uniformity:  4-step
  - Color Maintenance:  7-step
  - CRI:  ≥ 75 for indoor, silent for outdoor
  - Off-state Power prohibited
    - Exception for integral controls, limited to 0.5W
  - 3 Year Warranty
  - Thermal Management

# Overall Requirements (cont.)

- Modules/Arrays
  - Lumen depreciation ($L_{70}$)
    - Residential Indoor ≥ 25,000 hours
    - Residential Outdoor and all Commercial ≥ 35,000 hours
- Residential Outdoor Luminaires
  - Attached to buildings and > 13 watts requires photo-control
- Power Supplies
  - Power Factor
    - ≥ 0.7 Residential ≥ 0.9 Commercial
    - ≥ 120 Hz Output Operating Frequency
- Packaging states incompatibilities with photo-controls, dimmers, or timing devices

# Chromaticity



# Warranty

- Minimum of 3 years
- Covers repair or replacement of defective electrical parts including light source and power supplies
- Residential products must include a written warranty in the packaging.

# Thermal Management

- For *in situ* thermal management, manufacturers must adhere to:
  - device manufacturer guidelines
  - certification programs
  - test procedures

# Outdoor Luminaire Requirements

- Residential luminaires designed to attach to buildings
- If power consumption is greater than 13 watts the luminaire must contain an integral photo-sensor that prevents operation during daylight hours

# Power Supply Requirements

- Cannot exceed the manufacturer maximum recommended case temperature when measured during in-situ operation
- Power Factor
  - Residential products: $\geq$ 0.70
  - Commercial products: $\geq$ 0.90
- Minimum Operating Temperature: -20C for outdoor products

# Packaging Requirements

- Included documentation must clearly state any known incompatibility with:
  1. photo-controls
  2. dimmers
  3. timing devices

# Quality Assurance (QA)

- Testing flexibility - component substitutions and one product to represent full family
- 3rd party QA program will procure three marketplace samples
- Developing QA program procedures for early 2009
- Manufacturers required to participate
- Non-compliance terms

# Penalties for Non-compliance

- One product failure in a grouping will disqualify the entire group

- Two product failures in a grouping will place the applicant on a probationary list

- Probation suspends applicant's ability to use groupings and have to qualify each unique product separately

- Applicant is removed from probation after one year

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# Test Procedure Status

**We will be effective on Sept. 30**

- LM-79 Finalized
  - Luminaire efficacy, chromaticity, others
- LM-80 will be finalized shortly
  - Lumen Depreciation
- Most device manufacturers already have test data available
- Can verify results soon after LM-80 is final

# Expanding Category A

Additional applications:

- Street and area lighting
- Parking garage lighting
- Cove lighting
- Ceiling mounted luminaires
- Replacement lamp applications
- Display and accent lighting
- Wall-wash applications
- Others

# Ratcheting up the Efficacy

- Will keep ENERGY STAR on pace with technology
- Help drive us to Category B (70 lm/w)
- Will be scheduled well in advance
- DOE will engage the lighting industry before proposing a specific ratchet schedule

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